SOILutions

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NUTRIENT REQUIREMENTS OF PULSE CROPS

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The practice of including pulses in rotations with cereals and oilseeds has been steadily increasing over the past decade. Possible reasons for the increasing popularity of pulses as an alternative crop include improvement of soil quality, reduced fertilizer costs and, since pulses have generally produced a reasonable return during a period of low commodity prices, money in the bank.

Pulse crops' ability to fix nitrogen sets their fertility management apart from other annual crops. But eliminating the need for N fertilizer does not reduce the importance of soil fertility. Like any other crop a top notch fertility program is a key factor in optimization of pulse crop production. In this two part article, we will discuss nutritional management of field peas, lentils, and fababeans starting with nitrogen and phosphorus in this issue and continuing on to potassium, sulphur and micronutrients in the next.

Nitrogen

Since pulse crops are legumes, they can fix N from the atmosphere. As a result, the need for N from sources such as the breakdown of soil organic matter or addition of fertilizer and manure is reduced or eliminated. However, inoculation of the seed with the proper strain of *Rhizobium* bacteria is essential.

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GROWING OATS - DO YOU HAVE TO SACRIFICE YIELD FOR QUALITY?

Doug Penney
Acting Branch Head

Fortunately there are other good uses for oats besides making haggis which hasn't become a culinary delight except with a few hardy Scots. Traditionally oats have played only a minor role in feed and food grain markets, but in recent years, the premium feed oat (pony oats) and milling oat markets have expanded, and premium oats have fetched attractive prices.

Through the expansion of the premium oat market and attendant requests for production information, it became apparent that our knowledge of the effects of fertilization on yield and quality was very limited compared to other cereal crops. Thus in 1990, the Soils Branch, with financial support from Cargill, began a study on oat fertilization. The project was continued in 1991, again with support from Cargill plus a matching grant from the Alberta Agricultural Research Institute (AARI).

Cargill identified low protein in milling oats produced in the northern part of the prairie region as a major concern. They wanted to know if increasing N fertilizer rates would boost protein levels. The usual approach to oat production has been to keep fertilizer N rates low as a way of avoiding lodging and delayed maturity.

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THIS ISSUE:

Alberta Agriculture

Phosphorus Fertilizer Recommendations for Pulse Crops Based On Miller-Axley Soil Test.

Soil Test 0-6 in depth	Recommendation						
	Brown	Dark Brown	Thin Black	Black	Gray Wooded	Peace River	Irrigated
(lbs P/acre)	(lbs P2O5/acre)						
>80	0	0	0	0	0	0	0
60-80	20	20	20	20	20	20	20
50-60	20	20	25	25	25	25	30
40-50	20	25	30	30	30	30	40
30-40	25	30	35	35	35	35	45
20-30	30	35	40	40	40	40	50
10-20	35	40	45	45	45	45	55
0-10	40	45	50	50	50	50	60

Note that the soil test levels are based on the Miller-Axley procedure used by the Agriculture Soil and Animal Nutrition Laboratory. Since different methods give different results, labs using other methods will have their own interpretive guidelines.

Pulse Crops Cont.

Soil test results are important in making N fertility decisions. In a properly inoculated pulse crop growing on soils testing above 40 lbs N/acre in the 0-24 in depth addition of fertilizer N is unlikely to result in additional yield. Fertilizer N additions may in fact cause problems. Excess N will reduce the amount of N fixed by the legume, delay maturity as well as increase the potential for damage due to plant disease and fall frost.

On soils testing 20 lbs N/acre or less and showing good moisture to three feet, an addition of 20-25 lbs of fertilizer N will push yields into the optimum range.

It is important to remember that yield is correlated closely with not only nutrient status but also spring soil moisture and growing season precipitation. In the drier brown and dark brown soil zones, recropping to pulses should only be attempted when you have spring moisture to a depth of more than 2 ft.

Moisture is of course not a restraint under irrigation, and additions of up to 40 lbs N will generally improve yields and profits on soils testing low in N. One should be aware that irrigated soils can accumulate significant amounts of N below the surface layer. Sample to 2 ft and make allowance for the N in the 12-24 depth when deciding if additional N is required.

Midseason N applications may inhibit N fixation by the crop. So stay away from N fertigation. An exception would be under conditions of failed inoculation and obvious N deficiency. Then fertigation may be required to salvage the crop.

Phosphorus

Adequate levels of P are critical for high yield and early maturity. Phosphorus deficiency restricts top and root growth resulting in poorly developed root systems, spindly stems with few branches, and small narrow leaves. In extreme cases, P deficiency may show up as dark bluish-green or purplish coloration of the leaves.

Although P is still a limiting factor in many Alberta soils, build up of residual fertilizer P has raised available P levels to the point where P responses are generally not dramatic. This lack of obvious response in the field is further compli-

cated by inadequacies of soil testing methods. Soil tests do not always make an accurate prediction of crop response to P. Soils containing high levels of residual P from previous fertilizer applications may still test deficient, particularly on calcareous soils, yet crops may not respond to added P fertilizer. In other situations, soils that test high in P still respond to P fertilizer additions.

Despite these uncertainties, when soil test levels are low and only small amounts of P fertilizer have been applied in previous years, following the recommendation from the soil test report is probably the best advice. On soils that test medium to high in available P and have a 10-20 year history of regular fertilizer P applications, we generally recommend an annual maintenance application of 20 lbs P_2O_5. This amount will be adequate to meet immediate crop needs and replenish soil P that was removed.

Phosphate fertilizer reacts with cations such as Ca^{2+}, Fe^{3+}, and Al^{3+} in soil to form low solubility compounds. This process effectively immobilizes P in the soil and prevents migration towards the plant root. The root must in effect come to the P. So placing the P in a band or in the seedrow, where the roots can find it, results in more efficient fertilizer uptake in the year of application than would be achieved with broadcasting.

There are restrictions however. Germination and emergence of pulse crops can be reduced if more than 25 lbs P_2O_5 is seed placed. This limit can be pushed upward 5-10 lbs when good seedbed moisture is present or if seeding is done with an air seeder that produces a broad seed row. If more than 25 lbs P_2O_5 is required, banding before seeding should be used.

WORKING TOGETHER - Phosgypsum Research

Jerome Lickacz
Soils Branch

In the production of phosphate fertilizer, the mineral apatite or rock phosphate is treated with sulphuric acid. The reaction products include phosphoric acid and gypsum. The phosphoric acid can be used to produce a variety of fertilizer products such as mono-ammonium phosphate (11-55-0) . The gypsum by-product, referred to as phosgyp in the fertilizer industry, is generally stockpiled near the plant. In Alberta, there are phosgyp stockpiles near Medicine Hat, Calgary, Fort Saskatchewan, and Redwater.

Preliminary research by Alberta Agriculture, University of Alberta, and private consultants has shown potential for the use of phosgyp in the amelioration of problems associated with solonetzic soils, coal mine spoil, and salt water spills.

Both stockpiling phosgyp and its potential use as a commercial reclamation product has raised environmental and occupational health questions. Phosgyp contains radionuclides and heavy metals. These also occur naturally in soil in varying amounts depending on the origin of the parent geologic material. With respect to adding phosgyp to soil, the main concern is entry of radionuclides and heavy metals into the food chain through crops used for human and animal food or migration to surface and groundwaters.

In order to examine the phosgyp issue, the fertilizer industry in cooperation with various public sector institutes has developed a five year research program. University of Alberta's Department of Soil Science will examine the fate of the elements of interest when phosgyp is applied to soil through a series of laboratory experiments. Soils Branch will establish field trials to validate laboratory findings in the field and assess crop uptake of radionuclides and heavy metals. The project is jointly funded by Western Cooperative Fertilizers, Sherritt-Gordon, and Esso Chemical with matching funds provided by the Alberta Environmental Research Trust.

What the World Wants and What it Costs

Everyone needs a Christmas wish list. Here are some items from our collective catalogue along with prices. The dollar figures are per year. According to an over my coffee break survey, there are about one billion "haves" in the world and about four billion "have nots." Despite not being able to afford that big holiday this year, you are definitely one of the haves. So, each time a billion dollars is mentioned think "That would cost me a buck." By the way, I didn't make up the list and dollar figures over coffee. They are from a paper, "Do the Right Thing," prepared by the World Game Institute.

1. Eliminate Starvation and Malnourishment: $19B; $2B for 10 years for famine relief; $10B for 20 years on extension; $7B for indigenous fertilizer development. Closely linked to 2, 4, 5, 9, 10.

2. Health Care: $15B to provide primary health care to all areas of the world that do not currently have access to health care. Closely linked to 1, 3, 4, 5.

3. Eliminate Inadequate Housing and Homelessness: $21B for 10 years spent on making materials, tools, and techniques available to people without adequate housing. 1, 4, 5, 9.

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DRIS SYSTEMS

OR WHY BROOKS STAFF WEAR COWBOY BOOTS

R.C. McKenzie
Soil and Water Agronomist

There is increasing interest among agronomists in using tissue testing in the diagnosis of nutrient deficiencies and the optimization of fertilizer applications. Tissue testing holds the most promise for high value crops that receive large applications of fertilizer and for long lasting crops where more fertilizer can be added.

Most tissue testing techniques are interpreted using a sufficiency level approach, ie - nutrient concentration above a threshold value signifies that sufficient quantities of that nutrient are present. The threshold values are usually specified for a particular part of the plant at a certain stage of growth. As a result, the window of opportunity for diagnosis and correction is narrow. The sufficiency approach to tissue testing also tends to consider each nutrient in isolation and ignore interactions.

An alternative to the sufficiency approach is the Diagnostic Recommendation Integrated System or DRIS. First developed in South Africa by Beaufils for use on rubber trees and corn, DRIS has since been refinedmainly by Sumner at Atlanta, Georgia and applied to corn, alfalfa, soybeans, sunflowers, wheat and numerous other crops.

The advantages of DRIS arise from the use of nutrient ratios in plant tissue rather than nutrient concentration. Nutrient ratios are less dependent upon crop growth stage and can be based on whole plant analysis which simplifies sampling procedures.

In the DRIS system, interpretation of nutrient ratios is performed by comparing them to regional averages or DRIS norms. Developing DRIS norms is not a trivial exercise. A database must be assembled, factors affecting crop yield defined, and the relationships between factors expressed mathematically. This usually involves measuring yield and taking tissue and soil samples from a number of different fields in a region over a period of several years before the norms can be generated.

In 1989, a group consisting of Len Kryzanowski and Dan Heaney of Soils Branch and Judy Butt and I from the Brook's Center initiated a project aimed at developing DRIS norms for alfalfa and greenhouse cucumbers. In 1990 corn was added to the list.

Our reasons for choosing alfalfa were numerous. Alfalfa is an important crop in the irrigated areas of Alberta but it has not received as much nutrient monitoring or research as the cereal crops. Alfalfa stands normally last 5-8 years, it is therefore possible for nutrient deficiencies to develop that appreciably lower crop yield. There is also the possibility of correcting nutrient deficiencies within the lifespan of the crop. The DRIS data developed in Alberta could also be compared with norms developed in the Midwest United States.

The reasons for working with greenhouse cucumbers were also numerous. It is a high value crop ($250,000/acre, 30 acres in Alberta) grown under intensive management within a narrowly defined and carefully controlled environment. Alberta growers are already tuned in to tissue sampling. They regularly sample nutrient solutions, growing media, and leaf tissue and adjust fertilizer programs accordingly. However, they use the same range of acceptable tissue nutrient considerations regardless of crop growth stage.

Furthermore, Alberta greenhouses are subjected to more intense light than most greenhouses at comparable latitudes in areas such as Eastern Canada, United Kingdom, and the Netherlands. Nutritional requirements for optimum cucumbers growth in Alberta may be different from the above mentioned areas where most of the nutritional information has been developed.

Since the projects inception in 1989, data on a total of 55 irrigated alfalfa fields and 49 corn fields in the Bow Island, Taber, Vauxhall and Brooks areas has been assembled. In addition to yield and nutrient concentrations in tissue samples, soil samples were collected to a depth of 1.2 m. Soil measurements included moisture, particle size, EC, pH, as well as macro- and micronutrients. In terms of management factors, Lauretta Shuttleworth of the Brooks staff also collected data on variety, age of the stand, previous fertilizer applications and irrigation practices.

In the greenhouse program, crops of long English seedless cucumbers from 18 greenhouses in the Medicine Hat and Redcliff areas were sampled in both 1990 and 1991.

At the time of writing, analysis was not completed on 1991 samples and we did not have sufficient data from 1989 and 1990 to compute DRIS norms. However, as an exercise in using the system, soil and tissue analysis from alfalfa for 1989 and 1990 were compared to DRIS norms from the US Midwest. Both tissue and soil phosphorus were low on a number of alfalfa fields. In 1989, 8 out of 23 and in 1990, 4 out of 9 fields were below tissue phosphorus norms. Soil phosphorus, by Alberta soil test standards, was deficient in 13 out of 23 fields in 1989 and 8 out of 9 fields in 1990.

Tissue potassium was low in 11 of 23 alfalfa fields in 1989 but was adequate on all fields in 1990. In both 1989 and 1990, soil potassium on all fields was above Alberta standards. Since tissue nitrogen was high and tissue phosphorus and potassium were low, the N:P and N:K ratios are high by Midwest USA norms. This suggests that in many of the fields sampled, additions of P and/or K would be beneficial. It will be interesting to see if we obtain the same interpretation when we apply the Alberta norms to these same alfalfa fields.

The program will continue for at least another year thanks to funding from the Alberta Corn Committee, the Potash and Phosphate Institute, and Lakeside Research. The Alberta

Corn Committee also provided financial support during 1991. If we can in fact develop workable DRIS norms, the next step would be to package the database in some user friendly format using microcomputers and make the software available to producers. But that is still a year or two away.

Oh yes! The cowboy boot connection. We had to make cowboy boots part of our regulation field wear after numerous reports of rattlesnakes in corn fields along the Bow and Red Deer Rivers. So watch your feet, when your walking in the corn. ❄

Oats Cont.

Our goal was to develop a management system that would boost protein content and at the same time minimize production problems.

Thus far the program has consisted of two field experiments conducted at three locations in 1990 and six locations in 91. One experiment was aimed at determining nitrogen (N) and phosphorus (P) requirements for optimum yield and quality, and at calibrating soil tests. The second experiment evaluated post-seeding application of N as a method for increasing grain protein, raising N use efficiency and reducing lodging. Four methods of post-seeding application were evaluated at the 4 to 5 leaf and jointing stages.

Preliminary observations indicate strong relationships between grain yield, protein and nitrogen supply. At locations that received sufficient rainfall to produce moderately high yields (130 bu/ac), grain protein was relatively low (10 to 11%) unless high rates of N were applied.

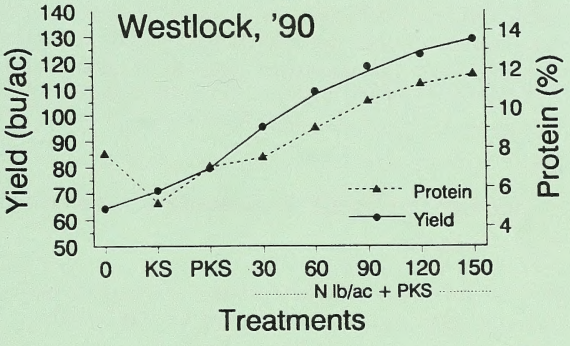
At a location with very low available soil N (Westlock-90), grain yield was moderate (80 bu/ac) but grain protein was very low (6 to 8%) without applied N. Nitrogen applications up to 150 lb/ac resulted in a progressive increase in both grain yield and protein. In contrast, at a location where there was severe drought stress (Tofield-91), grain yield was low (40 bu/ac) but protein was relatively high (17%) in the zero N plots. Under moisture limited conditions, application of N increased protein but had little effect on yield.

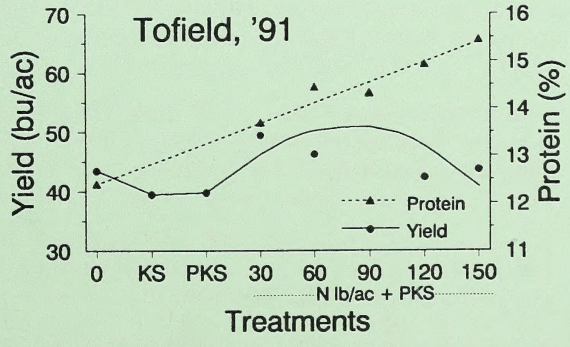
Results from the first two years of this study indicate that in Central and Northern Alberta where rainfall is usually adequate for relatively high yields of oats, moderate rates of N (30-60 lb/ac) produce yields in the 100 to 130 bu/ac range with 10 to 11% protein. High rates of N (90 to 150 lb/ac) produced yields in the 120 to 170 bu/ac range with 11 to 14% protein.

Not only did yields increase with increased rates of N, but the percentage of thin kernels increased as well. The increase in percentage of thin kernels and resulting loss of quality was not caused by lodging as it was not a significant factor at any of the locations. Our data suggest that certain quality factors such as protein and kernel plumpness may be inversely related. As a result strategies aimed at producing high yields and high protein content may conflict with those required to optimize other quality factors (i.e. uniform plump kernels).

In general post seeding application of N resulted in better N use efficiency than pre-plant application, but the results varied with location. At some locations, the greater efficiency was expressed as an increase in percent protein. While at others, it was expressed as a yield increase. We intend to continue our assessment of post seeding application on these two parameters as well as its effect on other quality criteria such as kernel plumpness.

Currently, oat producers use low rates of N and sacrifice yield and protein in favour of kernel plumpness. In regions were rainfall is sufficient to produce high yields, this strategy severely limits production potential. An alternative strategy and one that might prove more profitable would be to fertilize to maximize yield and protein and then screen out thin kernels after harvest. This would produce a premium high protein product with uniformly plump kernels. The screenings, high protein but thin kernels, could be disposed of on the local feed market.●





URBAN EROSION . . . . ??

Elston Solberg
Soil Agronomy Section

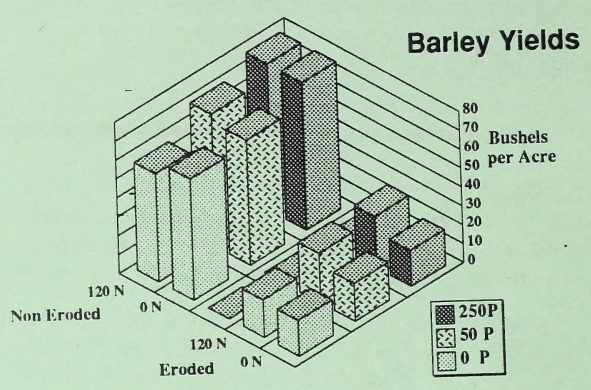
A drive around most any city or large town in Alberta (perhaps the world) will likely turn up areas where developers are offering topsoil for sale. This topsoil has been scalped from agricultural land for sale to urban gardeners and landscapers. Although this process does not involve wind or water, it still constitutes erosion in my books. The primary cause determining whether or not erosion takes place is nearness to an urban center, hence the name urban erosion.

How many acres of productive farm land are affected by urban erosion and how severe is the loss in productivity? These are not easy questions to answer. In order to get some idea on productivity loss, Soils Branch with the help of Stony Plain D.A. Ty Faechner, established a research trial just south of Spruce Grove.

Two identical experiments were established. One on a scalped area and the other approximately 100 yards away on an undisturbed area. Different combinations of phosphorous (0, 50 and 250 lb P_2O_5/ac) and nitrogen (0 and 120 lb N/ac) were applied. All treatments received a blanket application of K_2O and S (60 and 20 1b/ac respectively).

Yields from the eroded site (see figure) were consistently 35 to 60 bushels less than from the undisturbed site. In fact the maximum yield from the eroded plots was 27 bu/ac (inputs of 120 lb/ac of N and 250 lb/ac of P_2O_5), fully 37 bu/ac less than the non eroded check treatment (no N or P_2O_5).

Urban Erosion 1991



These results indicate a significant negative impact of urban erosion on productivity. Since most of our citie were originally established to service agriculture and since agriculture was centered on our most productive soils, urban erosion becomes yet another item on a long list of ways in which urbanites destroy our best agricultural land. (You city folk with your hackles up can just relax. There is a long list of ways in which the rural population contributes to soil degradation as well.)

I don't expect that the practice of scalping top soil will disappear. But data generated by experiments such as this will help us develop guidelines for top soil removal that minimize productivity losses due to urban erosion. ❋

World Wants Cont.

4. Provide Clean and Abundant Water: $50B for 10 years spent on water and sanitation systems. Closely linked to 1, 2, 3, 9.

5. Eliminate Illiteracy: $4.5B for 10 years; 10% spent on high tech communications; the remaining 90% on culturally appropriate literacy programs. Closely linked to 1, 2, 3, 4, 9, 10, 11.

6. Increase Fuel Use Efficiency: $33B for 10 years spent on increasing industrial and domestic energy and material use efficiency to state of the art. Closely linked to 7, 8, 12, 13, 14.

7. Increase Renewable Energy: $20B for 10 years spent on research, development, and implementation of renewable energy technology. 6, 8, 11, 12, 13, 14.

8. Debt Management: $30B for ten years spent on helping developing countries get out of debt and also helping banks to stay solvent. Closely linked to 1, 6, 7, 10, 11, 14.

9. Stabilize Population: $10.5B for ten years spent on making birth control universally available. Closely linked to 1, 2, 3, 4, 5.

10. Reverse Soil Degradation: $24B for ten years spent on programs that remove the most vunerable lands from annual crop production and promote the adoption of sustainable soil management techniques. Closely linked to 1.

11. Reverse Deforestation: $7B for ten years spent on reforesting 150 million hectares and enforcing forest protection programs. Closely linked to 10 and 14.

12. Reverse Ozone Depletion: $5B for twenty years spent on phasing in substitutes for CFC's. Closely linked to 14.

13. Stop Acid Rain: $8B for ten years on programs that place pollution control devices on all industrial users of coal. Closely linked to 6, 7, 11, 14.

14. Stop Global Warming: $8B for thirty years spent on reducing carbon dioxide, methane, and CFC release. Closely linked to 6, 7, 11, 12, 13.

My total comes to $255B. That's $255 per have per year, not a bad deal. Can we afford it. Well as a global village, mind you not a very friendly one, we're spending approximately one trillion dollars a year on ways to kill each other. That's $1000 per have per year or $200 per human per year in military spending.

D.J.H.

SOIL SEARCHING

The festive season is upon us, a new year is in sight, and initially our intention was to end this issue with a happy upbeat editorial. Instead we will end with a parable. Our offering is taken from the Sibylline Books. A collection of prophecies and parables much venerated and consulted (read "given plenty of lip service") by the ancient Romans. We felt this story had something to say to us about the problems of today's world and our seeming inability to deal with them until they have reached crisis proportions. We have tried to translate the story verbatim, but must confess that our Latin wasn't quite up to the task in spots.

Our story opens in a thriving Roman city set on the banks of a lovely river in the middle of a rich and fertile plain. There are abundant signs of progress and prosperity. Housing starts are up as developers rush to built tract homes on farmland. Nearby forests are being cut down as fast as the wood can be hauled away. Smoke from factories fills the air and sewage runs into the river. Traffic congests the streets. Politicians are forming task forces on how to spend surplus taxes; businessmen (this was before women's lib) are consulting with their accountants on ways to hide windfall profits; and bankers are handing out loans at exhorbitant rates of interest as fast as they can process the paperwork. Everybody is so happy.

One fine fall day, while the citizens are busy prospering, a strange old bag lady arrives at the gates of the city. In her shopping cart she is pushing twelve large books. She demands an audience with the city fathers.

The guard at the gate just laughs. "Why would the council want to meet with an itinerant bag lady?"

The bag lady smiles slyly. "Tell them I'm a rich but somewhat eccentric developer. I want to make a deal with the city, but it has to be made today."

A meeting is quickly arranged and the bag lady brought before the council that very afternoon (shopping cart and all).When the meeting is called to order, the old woman picks up one of the twelve books and with a flourish, shows it to the council and begins her pitch. "This set of twelve books are a rare limited edition. In fact one of a kind. They contain the sum total of the world's knowledge and wisdom. Today and today only you can have all twelve for the unbelievalbly low price of a single sack of gold."

The council laughs themselves sick at this idea. In fact his worship the mayor laughs so hard he chokes on his cigar and has to be rushed to emergency. The deputy mayor finally regains his composure. "Old woman you have no concept of the value of gold. You best leave town before we arrest you for practicing comedy without a licence."

"OK! OK! I'm on my way, but first I'm going to destroy half of the books."

So she builds a small bonfire and burns six of the books of all knowledge and wisdom in front of city hall. She then pushes her shopping cart out the gates and disappears across the plains.

A hard winter comes and goes. The city still flourishes but housing starts are down slightly, seasonally adjusted unemployment is up, and the retailers report consumer spending only grew by 2% compared to this same period last year.

One fine fall day, who should appear at the gates of the city? Why the bag lady of course. "Oh, you again!" say the city fathers. "How is the knowledge and wisdom business going?"

"Why just fine. I have six books. Just six left. Only half remains of all the knowledge and wisdom of the world and once again I am offering them for sale. Only the price is now two sacks of gold."

"You must be joking." Laughter fills the council chamber, although this time nobody ends up in emergency. (Smoking has been banned in public buildings.)

"Two sacks of gold for the six remaining books. Take it or leave it!"

"It seems to us that you are a little short of business savy, old woman." says the mayor, "Your new price is a four fold increase over an already outrageous price. You must be quite mad if you think we will pay more for less."

"Do you want them or not? No. Very well then. If I might trouble you for a little firewood."

And with that she builds another bonfire on the steps of city hall and burns three of the remaining books in front of the council and the citizens before setting off across the plains.

That night, one or two curious souls sneak down to city hall and sift through the embers to see if they can salvage the odd page or two. But the fire has burned very thoroughly and the old women has raked the ashes. There is nothing to salvage.

Another hard winter envelopes the city. This time the troubles are a little more severe. Bread lines form, crime rates go way up, and political cartoons of his worship the mayor start showing up in the local newspaper.

However, the winter turns to spring, trade picks up and by the following summer last winter's problems are no longer a priority issue. One fine summer day..... You're catching on. Have you heard this story before?

"You're early this year" says the mayor.

"Less to carry" explains the bag lady, showing them the three books. "A quarter of all the knowledge and wisdom in the world. Do you want it?"

"What's the price?"

"Four sacks of gold."

Continued Page 8

Fable Cont.

"We'd like to buy some wisdom and knowledge, but right at the moment our economy is a bit sluggish and the council has decided to follow a policy of fiscal restraint. So four sacks of gold are completely out of the question."

"Firewood please."

"Now wait an minute. This isn't doing anybody any good. We've been thinking about this and we've put together a small committee, chaired by my brother-in-law, to have a look at these books of yours. Let us evaluate them for a few months to see if they're worth anything to us and when you come back next year, perhaps we can give you some kind of a reasonable offer. However, we are certainly not able to offer four sacks of gold."

The old women shakes her head sadly. "No deal. Bring me the firewood."

"It will cost you." replies the mayor.

"No matter," the bag lady shrugs as she set about shredding two of the books. "They'll burn quite well by themselves." After watching the books burn she set off swiftly across the plains, leaving the people of the city to face another winter.

Needless to say it is not a good winter. Unemployment goes sky high as companies relocate to some new town called Constantinople where wages are cheaper and they can get better tax breaks. "Business is business" their CEO's tell the mayor. Despite fiscal restraint, the council runs a deficit. The air is full of smog. The river is full of shit. All the trees have been cut down. Most of the plain is under parking lots. Famine and pestilence sweep the city. Everybody is so unhappy.

Late in the spring, the bag lady returns. "Just one book left" she cackles, putting it down on the ground in front of her, "So I was able to carry my own firewood."

"How much?" queries the mayor, trying unsucessfully to keep the note of desperation out of his voice.

"Sixteen sacks of gold."

"Sixteen sacks of gold, but we budgeted for eight. We will need more time to study your proposition"

"Study Shmuddy! Take it or leave it. The bonfire starts in half an hour."

The council hurries off to conduct a fact finding mission. Twenty-nine minutes later they return. "Sixteen sacks is all we have left" pleads the mayor, "Times are hard. You must leave us with something."

The old women hums to herself as she starts to pile the kindling together.

"All right, all right! You win!" cries the mayor, as the flames start to catch. The crowd parts and the council pushes forward two shiny new shopping carts each laden with eight sacks of gold. "But this had better be good."

"Good! It's great. It's a shame you didn't see the rest of it." and with that she hands the book to the mayor and pushes her two shopping carts laden with gold out the city gates and across the endless and empty parking lots, leaving the citizens to survive as best they can with the one remaining twelfth of all the knowledge and wisdom that had been in the world.

I wonder where those Romans are today?

The Editors

29th Alberta Soil Science Workshop:

This year's workshop, "Management of Problem Soils," will be held February 18-20 at the Lethbridge Lodge in Lethbridge, Alberta. The plenary session will cover inventory of problem soils, soil quality and productivity, conservation of problem soils, and improvement options. These themes will be explored further in sessions on soils conservation, fertility, inventory, and reclamation plus volunteer sessions. For more information contact Gerry Becke, Agriculture Canada, Lethbridge, 403-327-4561; Ray Dowbenko, Sherrit Gordon, Edmonton, 493-8737; or Len Kryzanowski, Alberta Agriculture, Edmonton, 403-427-2530.

Environmental Soil Science Conference, Edmonton, August 8-15

Organized by the Canadian Land Reclamation Society and the Canadian Society of Soil Science, this conference will feature international experts, volunteer papers and posters, commercial exhibits, tours, and student awards. For more information on registration call Yash Kalra 403-435-7210, on program, Bill McGill 403-492-5397, on exhibits, Len Leskiw 403-434-0400.

Crop protection Update

February 18-20 at the Ellerslie Rugby Club, Edmonton. Upgrade your knowledge of crop protection principles and practices in a hands on multidisciplinary environment. WOW!!!! For more information, contact Denise Maurice at 403-427-7098, Edmonton.

SOILutions is published quarterly by Soils Branch, Alberta Agriculture. Your comments on current contents, ideas and contributions for future articles are welcome. For further information phone, fax, or write *Dan Heaney*, Soil and Animal Nutrition Laboratory, 905 O.S. Longman Bldg., 6909-116 st, Edmonton, Alberta, T6H 4P2, Phone (403)427-6361, Fax (403) 427-1439 **OR** *Elston Solberg*, Soils Branch, J.G. O'Donoghue Bldg., 7000-113 st, Edmonton, Alberta, T6H 5T6. Phone (403) 427-2530, Fax (403) 422-9745.